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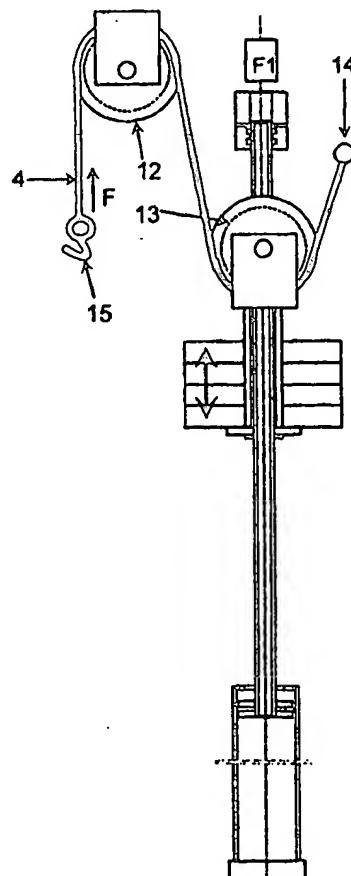
## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/SE97/00912		(81) Designated States: AL, AU, BA, BB, BG, BR, CA, CN, CU, CZ, EE, GE, GH, HU, IL, IS, JP, KP, KR, LC, LK, LR, LT, LV, MG, MK, MN, MX, NO, NZ, PL, RO, SG, SI, SK, TR, TT, UA, US, UZ, VN, YU, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).	
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(71)(72) Applicant and Inventor: VESTIN, Karl, Helge [SE/SE]; Olisborgsvägen 20, S-186 41 Vallentuna (SE);		Published <i>With international search report. In English translation (filed in Swedish).</i>	

(54) Title: DEVICE FOR WEIGHT OUTBALANCING IN CONNECTION WITH LIFTS

## (57) Abstract

Device for outbalancing a lifting tool and a load separately in connection with a lift. The lifting tool will be outbalanced with a counterweight, the load will be outbalanced by the force of a cylinder.



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### Device for weight outbalancing in connection with lifts

The invention relates to a lifting equipment that outbalances a weight. The balancing is intended to work independent from the size of weight within the working area.

#### Background to the invention

Today it is time-wasting to lift easy details with facilities. One wish is to find a lifting tool with the same movement speed as the hand of a human being. When an object is to be lifted with the help of a manipulator the following forces must be transmitted:

Force F1 weight of the detail

Force F2 weight of the lifting tool

Force F3 inertia of the manipulator

The total lifting force F will accordingly be  $F = F_1 + F_2 + F_3$ .

In a normal handling cycle appr. 50% of the time will handle the forces  $F_1 + F_2 + F_3$  and appr. 50% of the time will handle  $F_2 + F_3$ .

#### Purpose of the invention

To effect a lifting tool that follows the movements of your hand. The invention is below mentioned "manipulator".

#### Drawings

Figures 1-4 show the working function for the lifting device that outbalances a weight.

Figures 5-6 show the lifting device from the front and from the side.

Details on the drawing figures 5-6

1. Power plant e.g. electromagnet, electromagnetic field, pneumatic-hydraulic cylinder, mechanical arm and so on.
2. Slide valve.
3. Venting hole in the cylinder axis.
4. Cord.
5. Cylinder axis.
6. Slide with wheel.
7. Fore cylinder chamber.
8. Balance weight
9. Head cylinder.
10. Rear cylinder chamber.
11. Proportional valve.
12. Wheel I.
13. Wheel II.
14. Fastening point of cord.
15. Lifting tool.

Head components of the device

- A           Cylinder (9)
- B           A guide (6) with balance weight is mounted on the cylinder axis.
- C           Proportional valve (11).
- D           Cord (4) with wheels (12 + 13).

### Function description

The invention has two different force suppliers.

- A Counterweight that outbalances the lifting tool F2.
- B Force from the cylinder that outbalances the lifted detail F1.

The manipulator has two working modes:

- 1) When moving the manipulator without load but with a lifting tool F2
- 2) When moving the manipulator with load F1 + F2.

### Function according to drawing figures 1-4.

The drawing shows a cylinder axis (5) that is drawn out in its head position.

A guide is mounted on the cylinder axis, that is able to run up and down.

On the guide there is a counterweight (8).

One or several wheels (12 + 13) are mounted, depended on the transmission desired. The cord (4) has been drawn through the wheels and attached to its end in point 14. The other end of the cord has been connected to the lifting tool (15). When the lifting tool moves into a vertical level it will consequently be outbalanced.

### Lift of a detail

The cylinder axis is in its head position, as there will be a common pressure on both cylinder chambers (7 + 10). The space in the front chamber (7) is somewhat smaller owing to the surface of the axis, that will cause the axis to be fully projected. When there is a signal, the pressure in the lower cylinder chamber (10) will slowly fall. The axis (5) will consequently move down. The lower part of the slide valve (2) meets the

upper part of the slide (6). The slide (6) will be pressed down and the load (15) will be lifted. The pressure in the cylinder chamber (7 and 10 respectively) is constant, which results in the lifting force being constant in the whole operating range.

Drawing figures 1-4 show the working function in each routine

Fig. 1 Detail term

Fig. 2 The slide (6) can move up and down towards the cylinder axis without any effect when the axis is fully suspended. This function is normally used when the lifting tool moves without any load.

Fig. 3 Signal has been given that a lift of a detail shall start. Power plant (1) pushes the slide valve (2) down, which results in opening of the same. Exhaustion of the cylinder chamber (10) will start parallel with the exhaustion through the valve of the cylinder chamber (10).

Fig. 4 When the slide valve (2) meets the slide (6), the slide valve will be pushed up and closed. The exhaustion through the cylinder axis will cease. The exhaustion through the cylinder chamber (10) continues till there is a pressure desired.

**Patent Claims**

1. A device to be used in order to select two different lifting operations in a lifting manipulator:

1) lift of a lifting tool, 2) lift of a lifting tool incl. a load. These two operations shall be controlled by the motion speed of your hand within the operating range

*characterized in*

that a counterweight (8) outbalances a lifting tool (15) that is mounted in the end of a lifting cord. The cord is drawn through one or several wheels (12 + 13) depending on the exchange desired. When lifting a lifting tool incl. a load, a cylinder with an arranged piston and cylinder axis will be activated. The cylinder axis will actuate on the cylinder axis a movable slide (6) with an arranged wheel and the counterweight (8) and applies a force..

2. Device within the patent claim 1.

*characterized in*

that a cylinder (5) during the lift of a lifting tool only has a common pressure on its two chambers (7 + 10), which are divided by the piston. When lifting the lifting tool incl. a load the rear chamber will be exhausted to the pressure desired.

3. Device within the patent claim 1

*characterized in*

that the cylinder axis (5) is hollow and provided with a valve (2), that will start an exhaustion when pressed down, which results in the rear cylinder

chamber being emptied and the cylinder axis being moved into the cylindric block.

When the valve (2) meets the slide (6) it will be pressed upwards and the exhaustion will stop. The movement of the cylinder axis will stop.

1 / 2

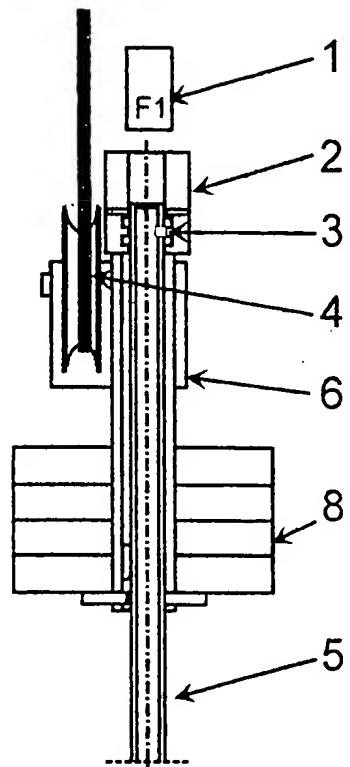


Fig.1

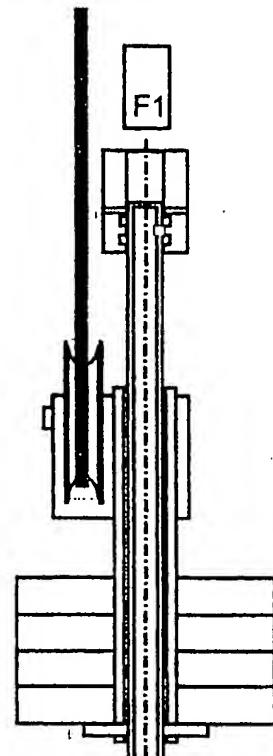


Fig.2

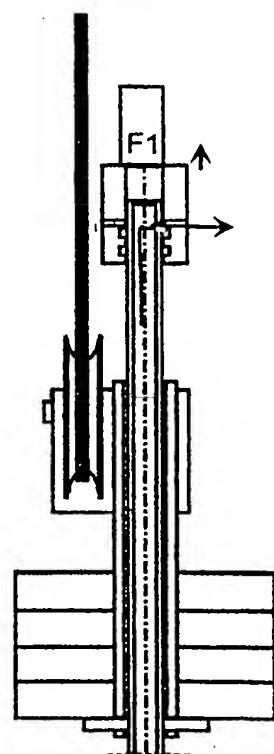


Fig.3

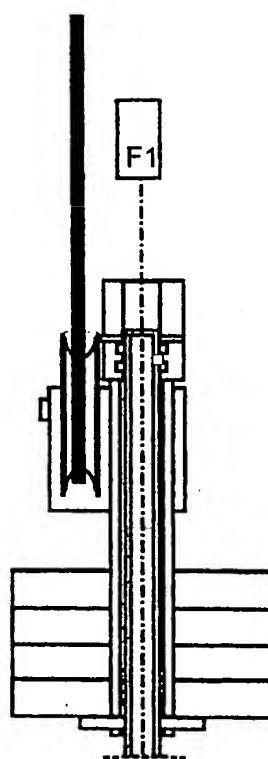
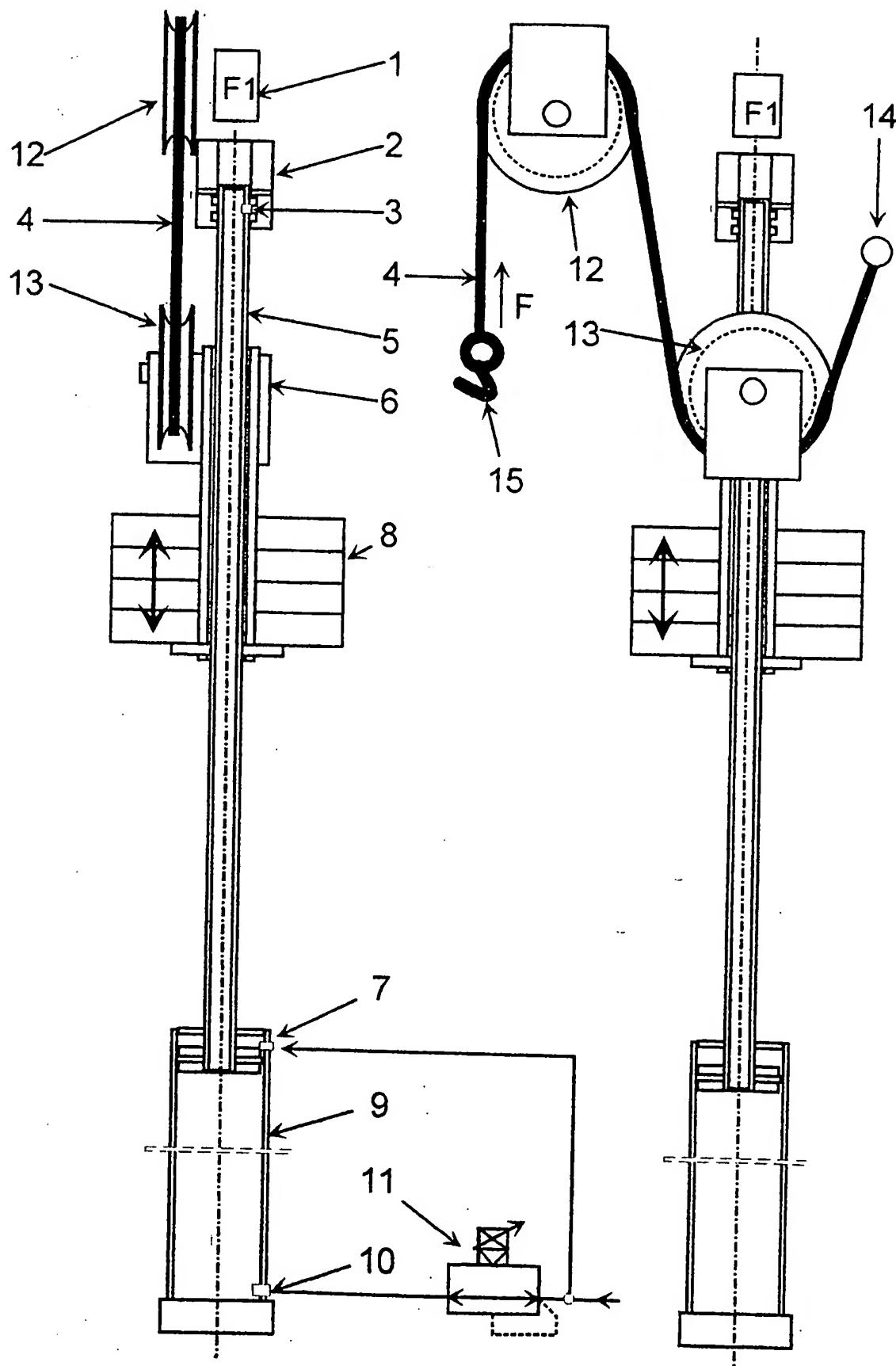


Fig.4



**FIG. 5      SUBSTITUTE SHEET (RULE 26)**

FIG. 6

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 97/00912

## A. CLASSIFICATION OF SUBJECT MATTER

**IPC6: B66C 23/72**

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

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**IPC6: B66C**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3259351 A (R.A.OLSEN), 5 July 1966 (05.07.66), figure 1 --	1
A	US 3259352 A (R.A.OLSEN), 5 July 1966 (05.07.66), figure 1, abstract --	1
A	US 3615067 A (N.G.GOUDREAU), 26 October 1971 (26.10.71), figure 1, abstract --	1
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## Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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